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EXAMINER	
CHEN, KEATH T	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/829,148	MALIK, ROGER J.	
	Examiner	Art Unit	
	KEATH T. CHEN	1712	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *07 June 2010*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-4, 8-19, 21-24, 26-31, 40-59, 63-78, 81-83, 92-113, 115-131, 133-135, and 144-155* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4,8-19,21-24,26-31,40-59,63-78,81-83,92-113,115-131,133-135 and 144-155* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 06/07/2010 has been entered.

Response to Amendment

1. The claim amendment filed on 06/07/2010, addressing claims 1-4, 8-19, 21-24, 26-31, 40-59, 63-78, 81-83, 92-113, 115-131, 133-135, and 144-155 rejection from the final office action (02/02/2010), by amending claims 1, 19, 23, 31, 49, 58, 101, and 102 is acknowledged and will be addressed below.

Claim interpretation

Claims 59 and 113 each recites “ceramic coating is said insulator”. This will be interpreted as “said conducting probes are insulated with ceramic coating”.

Claims 3, 22, 30, 52, 57, 83, 106, 111, and 134 will be examined as long as densified graphite is used, the property of “reduces … power" is intrinsic.

Claim Rejections - 35 USC § 112

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

2. **Claims 77, 78, and 155 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement and the enablement requirement.** The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claims 77 and 155 each recites “a cone-shaped vapor orifice”. Because the parent claim already set the limitations of “a nosecone”, there is no support of this additional limitation in the Specification to have both a nosecone and a cone-shaped vapor orifice.

3. Claims 19, 101, and 131 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicants regard as the invention.

Claim 101 recites the limitation "said cone-shaped vapor orifice" in line 7 on page 20. There is insufficient antecedent basis for this limitation in the claim.

Similarly, claim 131 and 19 each recites "said cone-shaped vapor orifice".

Claims 19, 101, and 131 will be examined as “said nosecone”.

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

4. Claims 1-2, 8-17, 19, 40, 43-45, 47-51, 55, 66-78, 92, 95-97, 99-100, 153, and 155 are rejected under 35 U.S.C. 103(a) as being unpatentable over Saito (JP 62-

237721, hereafter '721), in view of Applicant Admitted Prior Art (Fig. 4, p16, line 13 to p20, line 1, hereafter AAPA), De Lange (US 2508500, hereafter '500), Mercer (US 5407000, hereafter '000), and Kritzer (US 3133430, hereafter '430).

'721 teaches some limitations of:

Claim 1: an MBE growth device (title, fig. 1) with gallium source (#13, English translation, page 6, line 10) in a source cell (#12, line 11, the claimed "liquid metal evaporation source for MBE process" and the claimed "evaporator configured to evaporate liquid metal, said evaporator comprising a first cylindrical body from a first end to a second end", note the bottom is the first end and the upper end is the second end, note #12 is cylindrical, similar to Applicants Fig. 7A showing a cylindrical body) with a heater (#14, line 10, the claimed "said evaporator coupled to a first heater element" capable of "maintained at a first temperature for evaporating said liquid metal at said first temperature" that is higher than other two temperatures);

an external source reservoir (#20, line 12, the claimed "hollow reservoir cylinder for holding said liquid metal" and "maintained at a third temperature", as Gallium melting point is slightly above room temperature, intrinsically a third heater element is needed to maintain the melt);

a pipe (#28, line 15, the claimed "hollow transport tube for transporting said liquid metal from said hollow reservoir cylinder to said evaporator") connecting between source cell (at bottom of #12, "said first end") and source reservoir (#20),

a liquid surface monitor (#32, line 18) with electrode (#34) on the liquid surface (the claimed "conducting probe"), keeping temperature of liquid level constant (page 8,

lines 13-14, "for regulating a height of said liquid metal within said evaporator" and required a temperature sensor to sense the temperature and control the temperature);

a liquid surface monitor (#32, line 18) with electrode (#34) (the claimed "conducting probe is configured to sense contact with liquid metal in said evaporator by making a low resistance electrical contact");

liquid level monitor detects liquid level, closes valve (#30) by the detection signal (page 7, lines 17-21) therefore liquid level is kept constant (col. 7, last two lines) and liquid temperature constant (col. 8, lines 13-14) and strength of the molecular beam is also kept constant (page 8, lines 6-7; the claimed "an automatic feedback control circuit to regulate the level of said liquid metal in said evaporator to maintain a constant evaporation rate of said liquid metal from said evaporator at a fixed evaporator temperature, to transport said liquid metal from said reservoir cylinder to said evaporator if said conducting probe receives a signal from said automatic feedback control circuit, wherein said signal is indicative of said liquid metal being depleted in said evaporator", except piston is not taught);

operates at a temperature to evaporate Ga (therefore, the claimed "evaporate liquid metal at very high temperatures above the melting point of said liquid metal").

Applicant's claim requirements "first heater element … maintaining said evaporator at a first temperature", "third heater element … maintaining said liquid metal at a third temperature, wherein said third temperature being lower than said first temperature for holding said liquid metal in a liquid form", "a second heater … maintaining said hollow transport tube at a second temperature, wherein said second

temperature being less than said first temperature and greater than said third temperature", heater element for the pipe (#28) are considered intended use in the pending apparatus claims. Further, it has been held that claim language that simply specifies an intended use or field of use for the invention generally will not limit the scope of a claim (*Walter*, 618 F.2d at 769, 205 USPQ at 409; MPEP 2106). Additionally, in apparatus claims, intended use must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim (*In re Casey*, 152 USPQ 235 (CCPA 1967); In re Otto, 136 USPQ 458, 459 (CCPA 1963); MPEP2111.02). When the structure recited in the reference is substantially identical to that of the claims, claimed properties or functions are presumed to be inherent (*In re Best*, 562 F.2d 1252, 1255, 195 USPQ 430, 433 (CCPA 1977); MPEP 2112.01).

'721 does not teach the other limitations of:

Claim 1: (1A) (a hollow reservoir cylinder …) comprises a cylindrical piston,

(1B) (a hollow transport tube …) includes a second heater element,

(1C) a nosecone coupled to said evaporator, said nosecone comprising a second cylindrical body, at least one annular ring coupled to an external surface of said second cylindrical body and a tapered bore from a first opening adjacent to said liquid metal to a second opening remote from said liquid metal, wherein said nosecone disperses said evaporated liquid metal from said first opening to said second opening,

(1D) (at least one conducting probe) coupled to said nosecone; wherein said at least one said conducting probe comprises a third end coupled to said second cylindrical body and a fourth end residing between said first opening and a surface of said liquid metal for preventing condensation of said evaporated liquid metal on said second cylindrical body;

(1E) (each of said plurality of heater elements) includes a thermocouple configured to sense the temperature and control the temperature of said plurality of heater elements;

(1F) said reservoir cylinder and said piston are configured to prevent leakage of liquid metal through the mating surfaces of said reservoir cylinder and said piston;

(1G) said at least one said conducting probe controls a position of said piston in said reservoir cylinder, … controls a position of said piston in said reservoir cylinder to transport said liquid metal from said reservoir cylinder to said evaporator if said conducting probe receives a signal from said automatic feedback control circuit,

(1H) wherein said at least one annular ring is coupled to said second end for sealing said second end to said nosecone;

(1I) wherein said reservoir cylinder, said transport tube, and said evaporator are integrally connected within a vacuum system.

‘721 teaches a gravity feed from external source reservoir #20 to source cell #12 and is silent on the details of pipe #28.

AAPA is an analogous art in the field of MBE crucible (p27, lines 15-16). AAPA teaches a cylindrical evaporator 45, a nosecone 41 with a second cylindrical body coupled to evaporator 45 (similar Applicants Fig. 7A), an annular lip/ring 415 (the limitations of 1C and 1H, note it would be obvious to seal the nose cone to the evaporator to avoid unwanted vapor leakage from position other than nosecone opening), for the purpose of broadly diffuse the metal beam flux to improve the uniformity of the deposited metal films (p16, lines 18-19).

At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to have added a nosecone and annular lip, as taught by AAPA, to the top of the source cell #12 of '721, for the purpose of broadly diffuse the metal beam flux to improve the uniformity of the deposited metal films, as taught by AAPA (p16, lines 18-19) and/or for suitability (for annular lip). The selection of something based on its known suitability for its intended use has been held to support a *prima facie* case of obviousness. MPEP 2144.07. Note adding nosecone on top of the source cell #12 would have resulted the electrode #34 (conducting probe) coupled to the nosecone and the rest of the limitations of 1D.

‘500 is an analogous art in the field of metal coating (title) by evaporation (col. 1, line 3). ‘500 teaches a heating element (#5) for the intermediary tube (#27) to avoid solidification in the long narrow tube (Fig. 3, col. 5, lines 53-59) and a piston movable within vessel to maintain a constant level of molten metal (claim 3, col. 6, lines 51-60).

At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to have replaced the gravity feed of molten metal in the apparatus of '721 with a piston, as taught by '500, for the purpose of maintaining a constant level of molten metal, as taught by '500 (col. 6, lines 54-60) and required by '721's apparatus (the limitation of 1A). Note it is obvious to control the piston from the feedback control signal instead of controlling the valve #30 for the purpose of control liquid metal level, the limitation of 1G. Furthermore, a person of ordinary skill would have added a second heater to the intermediary tube/hollow transport tube, as taught by '500, to the long narrow pipe #28 for the purpose of avoiding solidification in the long narrow tube, as taught by '500 (col. 5, lines 53-59, the limitations of 1B).

'000 is an analogous art in the field of handling molten metal (title). '000 teaches a thermocouple (#74, Fig. 1, col. 8, lines 39-43) in the conduit/hollow transport tube and a sensor (#70) to measure the temperature of the molten metal (col. 3, lines 58-60) for the purpose of temperature control (col. 15, lines 14-20). Note the molten metal source is independently controlled by using sensor #70.

At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to have adopted thermocouple for maintaining temperature for each heater, as taught by '000 (col. 8, lines 39-43, the limitation of 1E). Note the

addition of the second heater to the intermediary tube/hollow transport tube is also taught by '000 (col. 8, lines 39-43, the limitation of 1B).

'430 is an analogous art in the field of closed circuit refrigerant conducting tubing (title, applicable to heating environment). '430 teaches integral one piece form of evaporator, tubing and condenser (col. 2, lines 14-18) without welds or reduction fitting between the various tubing length, numerous sources of possible leaks are eliminated (col. 2, lines 21-24).

At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to have integrally formed the source cell 12, as taught by '430 (col. 2, lines 14-18) the external source reservoir, and pipe (the limitation of 1I) in the apparatus of '721, for the purpose of eliminating leaks, as taught by '430 (col. 2, lines 21-24, the limitations of 1F, note reducing leakage of piston is common known requirement of piston, otherwise, piston will not function).

'721, AAPA, '500, and '000, together, discloses the claimed invention except for "reservoir cylinder, said transport tube, and said evaporator are integrally connected". It would have been obvious to a person having ordinary skill in the art at the time the invention was made to integral form these components, since it has been held that forming in one piece an article which has formerly been formed in two pieces and put

together involves only routine skill in the art. *Howard v. Detroit Stove Works*, 150 U.S. 164 (1893).

Claims 49, 50, and 55 are rejected for the substantially the same reason as claim 1 rejection above. (Note the "growth of high purity semiconductor layers" is an intended use, see discussion above).

The piston would have been fitted with a tight tolerance to avoid leak, therefore, to have had the limitation of claim 153; and the piston is intrinsically manually set (even computer control need manual input, for claims 40 and 92).

For claims 2, 47, 51, and 99, '721 is silent of the material of the apparatus. '000 further teaches the use of ceramic refractory material in molten metal container because it is non-reactive to molten metal (col. 6, lines 23-24), therefore, it would have been obvious for a person of ordinary skill in the art to have adopted ceramic refractory material as the evaporator, hollow transport tube, the reservoir, and/or the piston. Note the "machine from" is a product-by-process claim.

'721 further teaches the Ga liquid metal (claims 48 and 100); the reservoir, pipe, and evaporator are joined via a passageway (any portion of the zigzag pipe is considered a passageway, for claims 10, 14, 68, and 73); a cone shape orifice (the

inner portion of #12 as shown in Fig. 1, the outer portion of #12 is considered evaporator, which intrinsically meet the function described in claims 155, 19, and 78).

The use of flanges to connect machine parts along with nuts, screws, bolts or clamps with accompanying seals would have been obvious to one of ordinary skill in the mechanical arts. Furthermore, to have used refractory material for such connection to avoid reaction with the liquid metal ('000, col. 6, lines 23-24), including the well-known molybdenum and graphite refractory materials.

'721 further teaches the reservoir and the pipe are connected at right angle. However, '721 is silent on the connection details of these parts. It would have been obvious for a person of ordinary skill in the art to connect reservoir and the pipe by a leak-tight flange (for claims 9, 13, 67, and 72), a screws (the claimed threaded assembly of claims 11, 16, 69, and 74), a refractory clamp (for claims 12, 15, 70, 71, 75, and 76), a molybdenum or graphite nuts and bolts (for claim 17).

'500 further teaches means to actuate said piston (the claimed "automatically adjusted" of claims 43 and 95). '721 teaches to maintain the liquid metal level, therefore, in the above combination, it would be obvious to attach the feedback control using electronic system to the means to actuate said piston (the claimed "electronic feedback control circuit" of claim 44 and 96) with signal from the liquid level monitor (#32, the claimed "electronic feedback control circuit senses the electrical contact resistance between said liquid metal and said conducting probe" of claims 45 and 97).

'721 teaches the source cell #12 and the tube in concentric relationship and '430 teaches integral formation (for the limitations of claims 8 and 66).

'721 further teaches the inner cone shape container of the evaporator (#12, the claimed "cone-shaped vapor orifice") and teaches one liquid surface monitor (#32) at cone-shaped vapor orifice (the claim 77).

5. **Claims 101-105, 107, 109, 115-116, 118-131, 144, 147-149, 151-152, and 154 are rejected under 35 U.S.C. 103(a) as being unpatentable over '721, AAPA, '500, '000, and '430, further in view of Colombo (US 5827371, hereafter '371).**

'721, AAPA, '500, '000, and '430, together, teach all limitations of claim 1 which are applicable to Claim 101.

'721 further teaches a cone shape container of the evaporator (#12) with one liquid surface monitor (#32) in cone-shaped vapor orifice, but does not teach an evaporator and a cone-shaped vapor orifice, each having a conducting probe of claim 101.

Note that "for growth of high purity semiconductor layers" is an intended use, see discussion above.

'371 is an analogous art in the field of MBE effusion cell (abstract), particularly in using liquid metal (col. 3, line 9). '371 teaches a multi-section evaporation unit (Fig. 18,

for example) with a corresponding evaporator and cone shaped orifice (see Fig. 1 and 2, for example), for the purpose of cracking (col. 3, lines 43-54).

At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to have replaced the evaporator (#12) of '721 with the evaporator in Fig. 12, 1, and 2 of '371 that has distinct evaporator and orifice sections, for the purpose of cracking (col. 3, lines 43-54). Because the apparatus can be operated at different level of liquid height: in addition to operating liquid height in the cone shaped section as shown in '721, or in the based section/evaporator (as shown in Fig. 2 or Fig. 5 of '371), it would have been obvious for a person of ordinary skill in the art to have added a first liquid level monitor inside the based section/evaporator for the purpose to operate in the cracking mode (col. 3, lines 43-54) and maintain a constant level of liquid metal. The first liquid level monitor (one in the cylindrical portion of the evaporator) would have been below the liquid metal surface (especially when operated in cracking mode and/or when liquid is at a level filling the orifice as shown in '721, for claim 116).

'721 further teaches the liquid level monitor (#32, Fig. 1) with the electrode (#34) above the liquid metal (for claim 115).

The above combination intrinsically maintain evaporator at a high temperature to evaporate liquid metal (for claim 102, note "high" is a relative term); and three heaters

can be used in any temperature settings (including claims 103 and 104, see discussion of intended use above).

Claims 120, 105, 107, 109, 118, 121, 126, 122, 127, 123, 128, 124, 125, 129, 130, 131, 144, 147-149, 151, 152, 154 are rejected for substantially the same reason as claim 8, 51, 53, 1, 44, 9, 13, 68, 73, 11, 16, 70, 71, 75, 76, 19, 40, 43-45, 47, 48, 153 rejection discussed above, respectively.

Claim 119 is rejected for the reason discussed above in the combination of '500 and '000 with '721 for claim 1.

6. **Claims 3, 18, and 52-53 are rejected under 35 U.S.C. 103(a) as being unpatentable over '721, AAPA, '500, '000, and '430, further in view of David (US 4672813, hereafter '813).**

'721, AAPA, '500, '000, and '430, together, teach all limitations of claims 2, 15, and 51, as discussed above. All the heaters from prior art inherently emit IR (part limitations of claim 52).

'721, AAPA, '500, '000, and '430, together, do not teach the other limitations of:

Claims 3 and 52: refractory material is densified graphite.

Claim 18: refractory nuts and bolts made from densified graphite.

'813 is an analogous art in the field of combustion motor (title). '813 cites newer materials such as densified graphite offer advantages of high temperature resistance

and low thermal expansion (col. 1, lines 50-53). It is well-known that graphite is a refractory material, as discussed above.

At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to have adopted densified graphite as the refractory material for the refractory materials for evaporator, hollow transport tube, or the reservoir (for claims 3 and 52), or the piston (further for claim 3), and for the refractory nuts and bolts (for claim 18), for the purpose of providing high temperature resistance and low thermal expansion, as taught by '813.

Claim 53 is rejected for substantially the same reason as claim 2 rejection above ('000's refractory material does not react with liquid metal).

7. **Claim 106 is rejected under 35 U.S.C. 103(a) as being unpatentable over '721, AAPA, '500, '000, '430, and '371, further in view of '813.**

'721, AAPA, '500, '000, '430, and '371, together, teach all limitations of claim 105, as discussed above.

For substantially the same reason as claim 3 rejection above, claim 106 is rejected.

8. **Claims 4 and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over '721, AAPA, '500, '000, and '430, further in view of Finicle (US 5158750, hereafter '750).**

'721, AAPA, '500, '000, and '430, together, teach all limitations of claims 2 and 51, as discussed above.

'721, AAPA, '500, '000, and '430, together, do not teach the other limitations of:

Claim 4: evaporator, reservoir cylinder, transport tube, or piston is coated with pyrolytic graphite.

Claim 54: evaporator, reservoir cylinder, or transport tube is coated with pyrolytic graphite (or other materials listed).

'750 is an analogous art in the field of MBE (col. 1, line 27-28), particularly in coating metal (col. 1, line 26). '750 teaches coating of pyrolytic graphite on the external surface of crucible to alleviate cool top end of the crucible (col. 1, line 54-58) because of it's high thermal conductivity in plane direction (col. 3, lines 2-4).

At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to have coated pyrolytic graphite to the external surface to any of the evaporator, reservoir, transport tube, and /or piston of the above combination apparatus for the purpose of high thermal conductivity to reduce the temperature non-uniformity, as taught by '750.

9. **Claim 108 is rejected under 35 U.S.C. 103(a) as being unpatentable over '721, AAPA, '500, '000, '430, and '371, further in view of '750.**

'721, AAPA, '500, '000, 430, and '371, together, teach all limitations of claim 101, as discussed above.

For substantially the same reason as claim 4 rejection above, claim 108 is rejected.

10. **Claims 21-22 and 56-57 are rejected under 35 U.S.C. 103(a) as being unpatentable over '721, AAPA, '500, '000, and '430, further in view of Bullough et al. (US 4072599, hereafter '599).**

'721, AAPA, '500, '000, and '430, together, teach all limitations of claims 1 and 55, as discussed above. '721 is silent on the electrode material.

'721, AAPA, '500, '000, and '430, together, do not teach the other limitations of:

Claims 21 and 56: conducting probes are made from a non-reacting refractory material.

Claims 22 and 57: said refractory material is densified graphite.

'599 is an analogous art in the field of metallurgical industry (liquid metal, Field of the invention), particularly in metallurgical grade electrode. '599 teaches preparation of densified graphite electrode suitable for metallurgical grade electrode (col. 1, line 40 to col. 2, line 33, especially line 29).

At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to have adopted densified graphite as the electrode material in the above combined apparatus for its suitability use in liquid metal, as taught by '599. The selection of something based on its known suitability for its intended use has been held to support a *prima facie* case of obviousness. MPEP 2144.07.

11. **Claim 110 and 111 are rejected under 35 U.S.C. 103(a) as being unpatentable over '721, AAPA, '500, '000, '430, and '371, further in view of '599.**

'721, AAPA, '500, '000, '430, and '371, together, teach all limitations of claim 109, as discussed above.

For substantially the same reason as claims 21-22 rejection above, claims 110-111 are rejected.

12. **Claims 23-24, 26-27, 58-59, and 112-113 are rejected under 35 U.S.C. 103(a) as being unpatentable over '721, AAPA, '500, '000, '430, and '599, further in view of '371 and Bahney (US 2195071, hereafter '071).**

'721, AAPA, '500, '000, '430, and '599, together, teach all limitations of claims 22 and 57, as discussed above.

'371 is an analogous art as discussed in claims 8, 101, etc rejection above which discussed two conducting probes, one in the evaporator and another in the cone-shaped orifice.

'721, AAPA, '500, '000, '430, '599, and '371, together, teach all limitations of claim 111, as discussed above.

'721, AAPA, '500, '000, '430, '599, and '371, together, do not teach the other limitations of:

Claims 23 and 58: said conducting probes are at least one conducting probe is insulated from the walls of the evaporator.

Claim 112: said conducting probes are insulated from each other and insulated from the walls of the evaporator.

Claim 24: non-conductive ceramic coating.

Claims 59 and 113: ceramic coating is said insulator.

'071 is an analogous art in the field of molten metal (title), particularly with the level of melt (page 1, left, line 26). '071 teaches a suitable contacting means (the claimed probe) with wires surrounded by a protective tube of porcelain or the like (page 4, right, lines 62-end), to avoid contact be made if spatter occurs. Note '071 also teaches the use of graphite as electrode material (page 5, left, lines 11-13), consistent with '599 teaching of using densified graphite for metallurgical grade electrode.

At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to have applied porcelain protective tube (porcelain is a ceramic) the each monitor/probe in the vaporizer and in the cone-shaped orifice as taught by

‘071, to the combined apparatus of ’721, AAPA, ‘500, ‘000, ‘430, ‘599 and ‘371, for the purpose of avoiding contact be made if spatter occurs. Therefore, the probes would have been insulated from each other and from the wall of the evaporator.

Claims 26 and 27 are rejected for substantially the same reason as claims 115 and 116 rejection above.

13. **Claims 63-65 are rejected under 35 U.S.C. 103(a) as being unpatentable over ‘721, AAPA, ‘500, ‘000, and ‘430, further in view of Ueno (US 6279330, hereafter ‘330).**

’721, AAPA, ‘500, ‘000, and ‘430, together, teach all limitations of claim 55, as discussed above. ‘721 teaches the electrode (#34) of the monitor (#32) from top opening of the cone-shaped evaporator.

’721, AAPA, ‘500, ‘000, and ‘430, together, do not teach the limitations of:

Claims 63: at least one of said conducting probes makes a first contact with said liquid metal on its surface and makes a second contact with said liquid metal through conductive walls of said evaporator.

‘330 is an analogous art in the field of monitor liquid level sensor (col. 8, lines 45-53). ‘330 teaches sensors (#22 and #23, Fig. 1, upper right) installed on the side wall.

At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to have re-arranged the electrode/probe from the top opening of the evaporator to through the side wall of the evaporator wall, especially knowing the electrode would have interfered with the uniformity of the vapor from the evaporator nozzle.

'721, AAPA, '500, '000, and '430, together, disclose the claimed invention except for direction of the electrode connected to the evaporator. It would have been an obvious matter to re-arrange the electrode connection to the evaporator, since it has been held that rearranging parts of an invention only involves routine skill in the art. MPEP 2144.04 VI C.

Claims 64-65 are rejected for substantially the same reason as claims 43-44 rejection above.

14. **Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over '721, AAPA, '500, '000, '430, and '599, further in view of '330.**

'721, '500, '000, '430, and '599, together, teach all limitations of claim 22, as discussed above.

For substantially the same reason as discussed in claim 63 rejection above, claim 28 is rejected.

15. **Claim 117 is rejected under 35 U.S.C. 103(a) as being unpatentable over '721, AAPA, '500, '000, '430, '599, and '371, further in view of '330.**

'721, '500, '000, '430, '599, and '371, together, teach all limitations of claim 109, as discussed above.

For substantially the same reason as discussed in claim 63 rejection above, claim 117 is rejected.

16. **Claims 29-31 and 81-83 are rejected under 35 U.S.C. 103(a) as being unpatentable over '721, AAPA, '500, '000, and '430, further in view of Leycuras (US 20040238526, hereafter '526).**

'721, '500, '000, and '430, together, teach all limitations of claims 1 and 49, as discussed above. '721 is silent on the heater material and configuration.

'721, '500, '000, and '430, together, do not teach the limitations of:

Claims 29 and 81: said heater elements are (or at least one of said heater elements is) made from refractory materials.

Claims 30 and 83: heater element(s) is/are densified graphite.

Claims 31 and 82: said (plurality of) heater element(s) is/are configured in a serpentine or spiral fashion.

'526 is an analogous art in the field of high temperature heating device (abstract) and graphite resistance furnace (title). '526 teaches refractory densified graphite ([0056]) heater (Fig. 1) in with strip (#2) connected in succession via their ends (the claimed serpentine fashion) for the purpose of maximum Joule effect ([0017]).

At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to have incorporated the heater of '526 in the combined apparatus of '721, '500, and '000, for the purpose of maximum Joule effect ([0017]).

17. **Claims 133-135 are rejected under 35 U.S.C. 103(a) as being unpatentable over '721, AAPA, '500, '000, '430, '599, and '371, further in view of '330.**

'721, '500, '000, '430, and '371, together, teach all limitations of claim 101, as discussed above.

For substantially the same reason as discussed in claims 29-31 rejection above, claims 133-135 are rejected.

18. **Claims 41-42, 46, 93-94, and 98 are rejected under 35 U.S.C. 103(a) as being unpatentable over '721, AAPA, '500, '000, and '430, further in view of Natelson (US 3687632, hereafter '632) and Bacchi et al. (US 20030055533, hereafter '533).**

'721, '500, '000, and '430, together, teach all limitations of claims 40, 45, 92, and 97, as discussed above. '721 teaches feedback control as discussed above and obvious to use electronic system to control, as discussed claim 44 rejection above. '500 is silent on the details of piston.

'721, '500, '000, and '430, together, do not teach the limitations of:

Claims 41 and 93: said position is set using a micrometer screw attached to said linear motion vacuum feedthrough attached to a shaft driving said piston.

Claims 42 and 94: the position is set using a motor to drive said micrometer screw.

Claim 46 and 98: said electronic feedback control circuit applies power to a motor that drives a micrometer screw attached to said linear motion vacuum feedthrough attached to a shaft driving said piston.

‘632 is an analogous art in the field of transferring liquids between containers (title). ‘632 teaches micrometer screw arrangement (#412-416, Fig. 4, col. 9, lines 64-66) attached to a piston and rod (#401 and #410, col. 9, line 34 and 42, the claimed shaft) with a cam (#404) driven by motor (col. 9, lines 57-58) to move piston (#401) up and down (the claimed linear motion) for a high accuracy delivery of liquid (col. 9, lines 51-53).

‘533 is an analogous art in the field of transferring semiconductor wafer (abstract), particularly in vacuum pressure activated piston ([0012]). ‘533 teaches an actuation mechanism ([0078]) with a vacuum feedthrough ((#162, Figs. 12-13, [0078]) for piston (#152) and motors ([0130], for example).

At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to have incorporated the micrometer screw arrangement as taught by ‘632 in the combined apparatus of ’721, ‘500, ‘000, and ‘430, for the purpose of high accuracy delivery (col. 9, lines 51-53). Furthermore, to have adopted the vacuum actuation mechanism, as taught by ‘533, for suitability for the function of

actuation the piston. The selection of something based on its known suitability for its intended use has been held to support a *prima facie* case of obviousness. MPEP 2144.07.

19. **Claims 145-146 and 150 are rejected under 35 U.S.C. 103(a) as being unpatentable over '721, AAPA, '500, '000, '430, '599, and '371, further in view of '632 and '533.**

'721, '500, '000, '430, and '371, together, teach all limitations of claims 144 and 149, as discussed above.

For substantially the same reason as discussed in claims 41-42 and 46 rejection above, claims 145-146 and 150 are rejected.

Response to Arguments

Applicant's arguments filed 06/07/2010 have been fully considered but they are not convincing in light of the new grounds of rejection above.

20. In regarding to 35 USC 112 rejection, see the bottom of page 30 to the top of page 31, Applicants' amendment of the claim overcome previous 35 USC 112 rejection. However, the amendment also introduces new issues with 35 USC 112, see rejection above.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KEATH T. CHEN whose telephone number is (571)270-1870. The examiner can normally be reached on 6:30AM-3 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Cleveland can be reached on 571-272-1418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/KEATH T CHEN/
Examiner, Art Unit 1712